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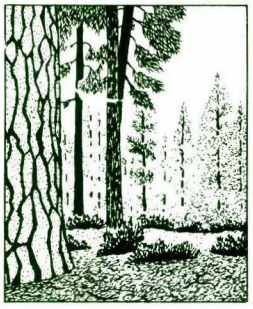

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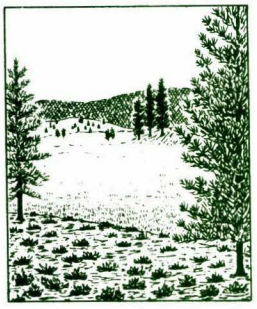

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EARLY SURVIVAL AND GROWTH OF SUGAR PINE AND WHITE FIR IN CLEAR-CUT OPENINGS

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The preponderance of white fir regeneration on sugar pine management units has always plagued forest managers in the sugar pine-fir type in the Sierra Nevada (fig. 1). Clear cutting small even-aged groups appears to offer at least a partial solution to this problem. In one recent study more white fir than sugar pine seedlings in openings died within 2 years, and more white firs were damaged by freezing and browsing. As a result sugar pine has a head start in the race for dominance.

The Study

The study area is part of the pilot-plant test of unit area control in sugar pine management on the Stanislaus Experimental Forest. During the summer of 1948 several overmature groups of mixed sugar pines and white firs were clear cut. Brush and the small white firs present on the areas were eradicated by a bulldozer while it piled slash. The clear-cut areas and surrounding buffer strips were treated with a lethal bait to reduce the rodent population. Seedtraps and permanent milacre quadrats were used to determine seed effectiveness. The seedtraps, evenly spaced at 1-chain intervals, were placed throughout the clear-cut areas. The permanent quadrats were in lines across the openings.

Results

During the autumn the regeneration areas received an abundant natural fall of sugar pine and fir seeds. An average of 29,000 sugar pine and 160,000 white fir seeds per acre was distributed throughout the clear-cut blocks.

The California Forest and Range Experiment Station is maintained at Berkeley in cooperation with the University of California.

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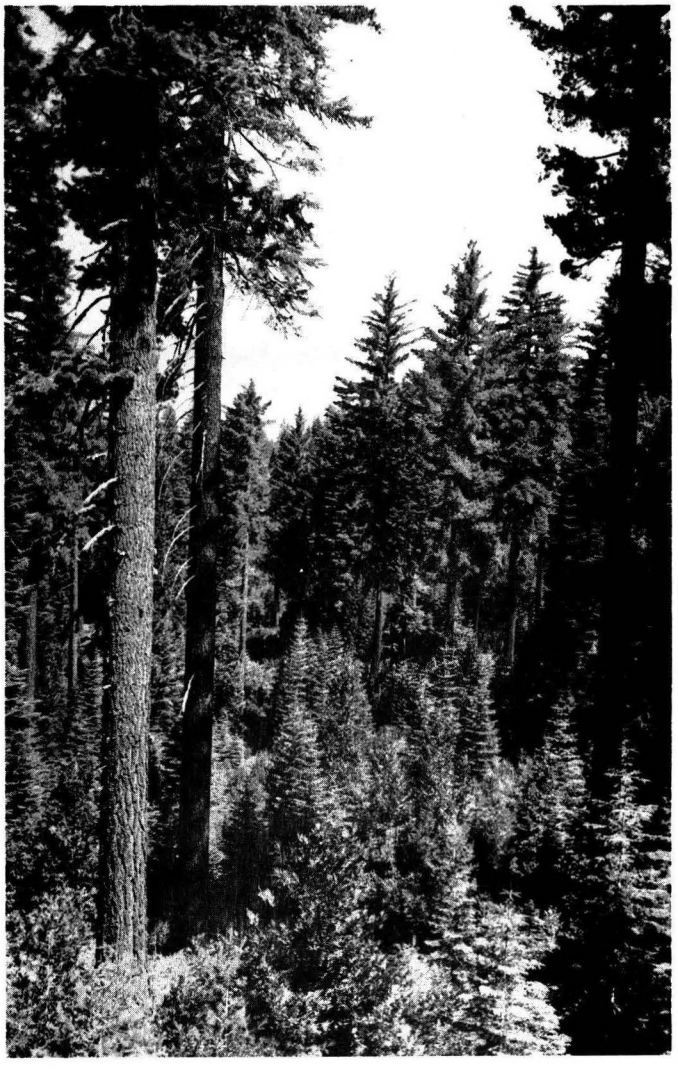

Figure 1.--White fir understory in the sugar pine-fir type in the Sierra Nevada.

At the time of the first reproduction survey in June 1949, the areas averaged 733 sugar pine and 14,298 white fir seedlings per acre. By fall of the same year the per acre stocking was reduced to 509 sugar pines and 7,235 white firs. At the end of the second growing season, there were 401 sugar pines and 3,798 white firs per acre. The total mortality for the 2-year period was 45 percent for sugar pine and 73 percent for white fir.

Although most of the new seedlings were sugar pines and white firs, some ponderosa and Jeffrey pine seedlings came in. Including these scattered trees, the original stocking of all pines was 803 and the final stocking at the end of 2 years was 458 per acre. Although the proportion of the pines in the new stand has only increased from 5 percent to 11 percent of the total stocking, the pines are by far the tallest trees (figs. 2 and 3).

White firs made the least height growth in the 8 years from 1949 to 1956, and Jeffrey pines made the most. Sugar pines were intermediate between white firs and Jeffrey pines, as shown in the following tabulation:

Species	Range in height (Feet)	Average height (Feet)	Basis (Number)
Sugar pine	0.7 - 6.1	2.9	100
Jeffrey pine	1.8 - 8.2	4.3	40
White fir	0.2 - 2.3	0.6	100

Young sugar pines normally grow faster than white firs of the same age, but the large difference in average height is not due entirely to inherent growth characteristics. Late spring freezes during 5 of the 8 years damaged white firs more than the sugar pines. In June 1954, when the temperature dropped below 20° F., most of the new growth on the terminals and laterals of the white firs was completely destroyed. The only white firs which sustained little or no damage were those sheltered by brush or pines. Although there were too few red firs in the clear-cut openings for conclusive comparisons of frost resistance, red fir appeared to be intermediate between white fir and sugar pine (fig. 3). None of the ponderosa or Jeffrey pines were injured by any of the late spring freezes.

Browsing damage by deer was also observed throughout the regeneration areas. As with freezing injury, white firs were hit hardest, whereas the pines were seldom molested.

Figure 2.--Seven-year-old sugar pine and white fir seedlings, Stanislaus Experimental Forest, August 1955. The small plant in the center foreground is a white fir. It is flanked on each side by a much taller sugar pine.

Figure 3.--In the center is a 7-year-old Jeffrey pine almost 7 feet high and in the right foreground is a 7-year-old red fir, Stanislaus Experimental Forest, August 1955.

Conclusions

Differences in mortality and growth rates between white fir and sugar pine in clear-cut openings are of practical silvicultural value. In the management of white fir, clear-cut openings should be avoided where late spring freezes and heavy deer browsing are expected. This is especially true where white fir Christmas trees are to be grown; the damage increases the time required to produce a tree of suitable size and quality. White firs, either for Christmas trees or sawtimber, should be started under partial shade of an overstory. After the trees are well established and the susceptibility to injury is reduced, the overstory may be removed.

In the management of sugar pine, clear-cut openings are recommended for the sugar pine-fir type. The higher survival of sugar pine seedlings increased the proportion of potential sugar pine crop trees in the new stands. The retarding effect of freezing and browsing on white fir height growth favored sugar pine and helped the pine to express early dominance.

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